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Microwave-Assisted Synthesis of Some 2,4-Thiazolidinedione Derivatives

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ABSTRACT: *The condensation of 5-[4′-(2″-haloethoxy)benzylidenyl]-2,4-thiazolidinediones* **2** *when separately carried with different 2-amino thiazoles* **3** *and different sulphanilamides* **4** *in DMF, using potassium hydroxide in the presence of a catalytic amount of a phase transfer catalyst, gave new 5-[4′-(4″-aryl-thiazol-2″-yl-aminoethoxy)-3′/5′-substituted benzylidenyl]-2,4-thiazolidinediones* **5** *and 5-[4′-(2″/4″-sulphonamidophenyl aminoethoxy)-3′/5′-substituted benzylidenyl]-2,4-thiazolidinediones* **6** *derivatives in good yields, respectively. The structures of all new compounds were established from analytical and spectral data. All the reaction sequences were carried under microwave irradiation, as an efficient tool.* © 2009 Wiley Periodicals, Inc. Heteroatom Chem 20:151–156, 2009; Published online in Wiley InterScience (www.interscience.wiley.com). DOI 10.1002/hc.20528

INTRODUCTION

2,4-Thiazolidinedione moiety is the generic feature of the glitazone antidiabetic agents [1]. The derivatives of 2,4-thiazolidinedione are found to be more beneficial in type 2 diabetes [2]. These 2,4-thiazolidinedione derivatives differ by the nature of the group attached to the 2,4-thiazolidinedione nucleus. In general, it has been found that the presence of phenoxyethyl chain (an ether linkage) increases the potency of the parent compound [3]. During recent years, numerous reports on additional 2,4-thiazolidinediones having phenoxyethyl chain have been appeared and many of the derivatives are used for the treatment of diabetes [4]. Ciglitazone, pioglitazone, rosiglitazone, englitazone, etc. are 2,4-thiazolidinedione derivatives and all of them contain a phenoxyethyl chain [5,6].

The use of microwave (MW) heating in organic synthesis is continuing to grow in last years, receiving widespread acceptance, and becoming an indispensable tool [7]. Microwave energy can offer numerous benefits for performing the synthesis of organic compounds including reduced pollution, increased reaction rates, yields enhancements, and cleaner chemistries [8–10]. In addition, using MW technology, it is often possible to develop economic and environmentally friendly synthetic protocols [11].

Encouraged by all these facts and as part of our continuing research program dealing with the synthesis of heterocyclic systems, particularly those containing a 2,4-thiazolidinedione moiety [12], we have undertaken the MW-assisted synthesis of 5-[4′-(4″-aryl-thiazol-2″-yl-aminoethoxy)-3′/5′-substituted benzylidenyl]-2,4-thiazolidinediones (**5a–i**) and 5-[4′-(4″-sulphonamidophenyl aminoethoxy)-3′/5′-substituted benzylidenyl]-2,4-thiazolidinediones (**6a–f**), which may show good biological and medical applications.

RESULT AND DISCUSSION

The required starting material (i.e., 2,4-thiazolidinedione) has been prepared by earlier

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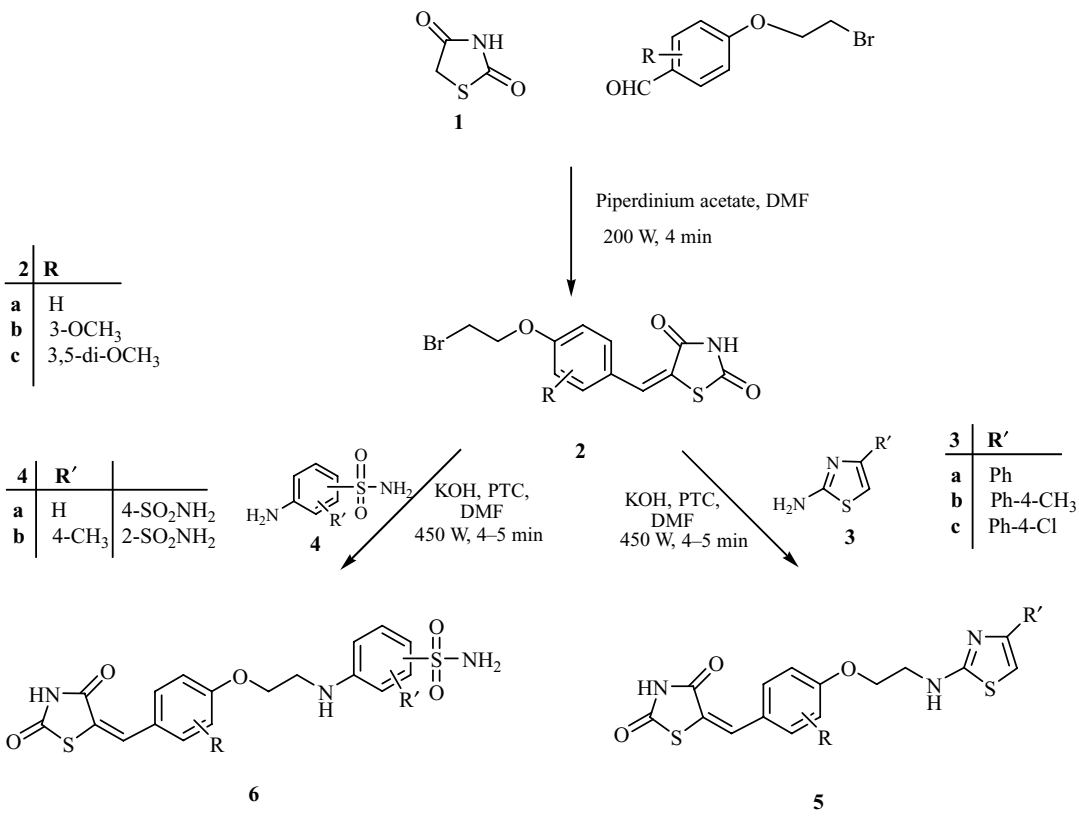

SCHEME 1

reported method [13]. We envisaged that the 5-[4′-(2″-bromoethoxy)-3′/5′-substituted benzylidenyl]-2,4-thiazolidinediones **2** may prove to be a useful intermediate in the condensation reaction with 2-aminothiazoles and sulphanilamides. The key intermediate **2** used in the present work was readily prepared by the treatment of 2,4-thiazolidinedione with substituted bromoethoxy benzaldehydes in the presence of a catalytic amount of piperidinium acetate. The reaction was carried out under 200-W MW irradiation for 4 min. The reactivity of **2** toward 2-aminothiazoles **3** and sulphanilamides **4** was investigated.

Phase transfer catalyst (PTC) is a powerful catalyst accomplishing a variety of reactions, including alkylations, under mild conditions, in a selective and efficient way [14]. The coupling of PTC-catalyzed reactions with MW activation was proved to be quite fruitful [15,16]. Taking this into account, the formed compound **2** was treated with substituted 2-aminothiazoles **3** by using potassium hydroxide in the presence of a catalytic amount of a PTC (tetrabutyl ammonium bromide) in DMF under 450-W MW irradiation for 4–5 min and obtained the 5-[4′-(4″-phenyl-thiazol-2″-yl-aminoethoxy)-3′/5′-benzylidenyl]-2,4-thiazolidinediones **5** in good yields (Scheme 1). The required 2-aminothiazoles **3** were prepared by the Hantzsch method [17]. The structures of the latter compounds were established on the basis of analytical and spectral data. The ^{1}HNMR spectra of **5** revealed, in addition to an aromatic multiplet, one broad signal at δ_H 8.10 ppm attributed to the NH proton, which is readily exchanged upon the addition of deuterium oxide.

On the other hand, the treatment of compound **2** with substituted sulphanilamides **4** results in the formation of 5-[4′-(4″-sulphonamidophenyl aminoethoxy)-3′/5′-substituted benzylidenyl]-2,4-thiazolidinediones **6**. The reaction was carried with potassium hydroxide and a catalytic amount of a PTC (tetrabutyl ammonium bromide) in DMF under 450-W MW irradiation for 4–5 min (Scheme 1, Table 1). The required sulphanilamide was prepared by the following literature method [18]. The IR spectrum of compound **6** showed the presence of SO_2NH_2 stretching bands at 1306 and 1143 cm^{-1}. The ^{1}HNMR spectra of **6** revealed one broad signal at δ_H 5.10 ppm and one signal at δ_H 10.12 ppm attributed to the NH proton and SO_2NH_2 protons, respectively, which are readily exchangeable with deuterium oxide.

TABLE 1 Physical Data of the Synthesized Compounds **5a–i** and **6a–6f**

Product	*R*	*R′*	*Microwave (450 W) Reaction Time (min + s)*	*Melting Point (°C)*	*Yields (%)*
5a	H	Ph	4	233	83
5b	3-OCH_3	Ph	4 + 15	260	67
5c	3,5-*di*-OCH_3	Ph	4 + 20	242	74
5d	H	Ph-4-CH_3	4 + 5	210	84
5e	3-OCH_3	Ph-4-CH_3	4 + 15	218	80
5f	3,5-*di*-OCH_3	Ph-4-CH_3	4 + 15	238	75
5g	H	Ph-4-Cl	4 + 10	259	76
5h	3-OCH_3	Ph-4-Cl	4 + 15	224	72
5i	3,5-*di*-OCH_3	Ph-4-Cl	4 + 15	247	79
6a	H	H	4	129	68
6b	3-OCH_3	H	4	167	64
6c	3,5-*di*-OCH_3	H	4 + 10	176	66
6d	H	4-CH_3	4 + 10	142	67
6e	3-OCH_3	4-CH_3	4 + 15	156	70
6f	3,5-*di*-OCH_3	4-CH_3	4 + 15	172	71

In conclusion, we have developed a simple and efficient method for the *N*-alkylation of 2-aminothiazoles and sulphanilamides with 5-[4′-(2″-bromoethoxy)-3′/5′-substituted benzylidenyl]-2,4-thiazolidinediones that occurs under mild conditions, using combined PTC-MW techniques. Moreover, the mild reaction conditions, short reaction times, high yields of the products, ease of workup, and the environmentally friendly nature of the procedure make the present method a useful and important addition to the known methods for the *N*-alkylation reactions.

EXPERIMENTAL

Melting points were recorded by open capillary method and are uncorrected. All the reactions were carried out in a commercially available Samsung 800 T domestic MW oven having a maximum power output of 800 W. Elemental analyses were performed on a Perkin Elmer elemental autoanalyzer. IR spectra were recorded on a Perkin Elmer RX-I FT IR spectrometer. ^{1}HNMR spectra were recorded on a Bruker Advance II FT 400-MHz spectrometer with tetramethylsilane as the internal standard.

*Synthesis of 5-[4′-(2″-Bromoethoxy)-3′/5′-substituted benzylidenyl]-2,4-thiazolidinediones (**2a–c**): General Procedure*

A mixture of substituted bromoethoxybenzaldehyde (0.01 mol) and 2,4-thiazolidinedione (0.01 mol) and a catalytic amount of piperidinium acetate were dissolved in DMF (2 mL) and the solution was exposed to 200-W MW radiation for 4 min. After the completion of the reaction, the reaction content was poured on to ice cold water. The crude product obtained was crystallized with ethanol. The purity of the compound was checked with TLC.

*5-[4′-(2″-Bromoethoxy)benzylidenyl]-2,4-thiazolidinedione (**2a**).* Yield: 78%, mp 186°C; IR (KBr, cm^{-1}): 3206 (NH), 3113 (CH aromatic), 2910 and 2742 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1712 and 1686 (2CO), 1325 (CN), and 784 (CBr); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 3.74 (t, 2H), 4.39 (t, 2H), 6.56 (d, $J = 8.2$ Hz, 2H, Ar-H), 7.04 (d, $J = 8.2$ Hz, 2H, Ar-H), 7.65 (s, 1H, vinylic-H), and 11.65 (br s, 1H, NH); Anal.: Calcd. for $C_{12}H_{10}BrNO_3S$ (327): N, 4.29; S, 9.79; Found: N, 4.27; S, 9.71.

*5-[4′-(2″-Bromoethoxy)-3′-methoxybenzylidenyl]-2,4-thiazolidinedione (**2b**).* Yield: 84%, mp 177°C; IR (KBr, cm^{-1}): 3215 (NH), 3133 (CH aromatic), 2933 and 2757 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1735 and 1691 (2CO stretching vibrations), 1332 (CN), and 797 (CBr); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 3.84 (s, 3H), 3.93 (t, 2H), 4.42 (t, 2H), 6.81 (d, $J = 2.9$ Hz, 1H, Ar-H), 7.12 (dd, $J = 8.9$ Hz and 8.3 Hz, 1H, Ar-H), 7.48 (d, $J = 8.3$ Hz, 1H, Ar-H), 7.62 (s, 1H, vinylic-H), and 11.68 (br s, 1H, NH); Anal.: Calcd. for $C_{13}H_{12}BrNO_4S$ (357): N, 3.93; S, 8.97; Found: N, 3.75; S, 9.00.

*5-[4′-(2″-Bromoethoxy)-3′,5′-dimethoxybenzylidenyl]-2,4-thiazolidinedione (**2c**).* Yield: 80%, mp 197°C; IR (KBr, cm^{-1}): 3219 (NH), 3154 (CH aromatic), 2925 and 2761 (CH aliphatic asymmetric

and symmetric stretching vibrations, respectively), 1741 and 1694 (2CO stretching vibrations), 1339 (CN), and 794 (CBr); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 3.87 (s, 6H), 3.98 (t, 2H), 4.45 (t, 2H), 6.98–7.04 (s, 2H, Ar-H), 7.71 (s, 1H, vinylic-H), and 11.70 (br s, 1H, NH); Anal.: Calcd. for $C_{14}H_{14}BrNO_5S$ (387): N, 3.62; S, 8.27; Found: N, 3.33; S, 8.05.

*Synthesis of 5-[4′ − (4″-Phenyl-thiazol-2″-yl-aminoethoxy)-3′/5′-substituted benzylidenyl]-2,4-thiazolidinediones (**5a–i**): General Procedure*

A mixture of **2** (0.005 mol), 2-amino-4-substituted aryl thiazole **3** (0.005 mol), powdered KOH (0.006 mol), and a catalytic amount of a PTC was dissolved in DMF (4 mL). The reaction mixture was then exposed to 450-W MW radiation for 4–5 min. The reaction mixture was cooled, the content was poured on to ice cold water, and the reaction mixture was then neutralized to pH 7. The crude product obtained was crystallized with aqueous DMF.

*5-[4′-(4″-Phenyl-thiazol-2″-yl-aminoethoxy)benzylidenyl]-2,4-thiazolidinedione (**5a**).* IR (KBr, cm^{-1}): 3430 (2NH), 3120 (CH aromatic), 2962 and 2922 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1659 and 1599 (2CO stretching vibrations), 1310 (CN stretching), and 1253 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 3.04 (t, 2H), 4.02 (t, 2H), 6.6–7.15 (m, 9H, Ar-H), 7.41 (s, 1H, thiazolyl-H), 7.74 (s, 1H, vinylic-H), 8.10 (br s, 1H, NH), and 11.52 (br s, 1H, NH); Anal.: Calcd. for $C_{21}H_{17}N_3O_3S_2$ (423): N, 9.93; S, 15.13; Found: N, 9.80; S, 15.10.

*5-[4′-(4″-Phenyl-thiazol-2″-yl-aminoethoxy)-3′-methoxybenzylidenyl]-2,4-thiazolidinedione (**5b**).* IR (KBr, cm^{-1}): 3434 (2NH), 3120 (CH aromatic), 2962 and 2930 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1687 and 1596 (2CO stretching vibrations), 1304 (CN), and 1266 (COC); ^{1}H NMR ($CDCl_3$ + DMSOd_6, δ ppm): 3.10 (t, 2H), 3.78 (s, 3H), 4.13 (t, 2H), 6.69–7.21 (m, 8H, Ar-H), 7.45 (s, 1H, thiazolyl-H), 7.78 (s, 1H, vinylic-H), 8.14 (br s, 1H, NH), and 11.60 (br s, 1H, NH); Anal.: Calcd. for $C_{22}H_{19}N_3O_4S_2$ (453): N, 9.29; S, 14.13; Found: N, 9.10; S, 14.07.

*5-[4′-(4″-Phenyl-thiazol-2″-yl-aminoethoxy)-3′,5′-dimethoxybenzylidenyl]-2,4-thiazolidinedione (**5c**).* IR (KBr, cm^{-1}): 3419 (2NH), 3116 (CH aromatic), 2978 and 2933 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1670 and 1589 (2CO stretching vibrations), 1321 (CN), and 1270 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 3.14 (t, 2H), 3.90 (s, 6H), 4.22 (t, 2H), 6.91–7.24 (m, 7H, Ar-H), 7.47 (s, 1H, thiazolyl-H), 7.95 (s, 1H, vinylic-H), 8.24 (br s, 1H, NH), and 11.72 (br s, 1H, NH); Anal.: Calcd. for $C_{23}H_{21}N_3O_5S_2$ (483): N, 8.70; S, 13.26; Found: N, 8.66; S, 13.20.

*5-[4′-(4″-Phenyl-(4‴-methyl)-thiazol-2″-yl-aminoethoxy)benzylidenyl]-2,4-thiazolidinedione (**5d**).* IR (KBr, cm^{-1}): 3451 (2NH), 3132 (CH aromatic), 2970 and 2907 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1680 and 1585 (2CO stretching vibrations), 1312 (CN), and 1270 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 2.88 (s, 3H), 3.05 (t, 2H), 4.10 (t, 2H), 6.65–7.19 (m, 8H, Ar-H), 7.42 (s, 1H, thiazolyl-H), 7.75 (s, 1H, vinylic-H), 8.12 (br s, 1H, NH), and 11.59 (br s, 1H, NH); Anal.: Calcd. for $C_{22}H_{19}N_3O_3S_2$ (437): N, 9.62; S, 14.65; Found: N, 9.48; S, 14.53.

*5-[4′-(4″-Phenyl-(4‴-methyl)-thiazol-2″-yl-aminoethoxy)-3′-methoxybenzylidenyl]-2,4-thiazolidinedione (**5e**).* IR (KBr, cm^{-1}): 3433 (2NH), 3126 (CH aromatic), 2961 and 2913 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1677 and 1591 (2CO stretching vibrations), 1310 (CN), and 1257 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 2.91 (s, 3H), 3.09 (t, 2H), 3.83 (s, 3H), 4.16 (t, 2H), 6.71–7.25 (m, 7H, Ar-H), 7.46 (s, 1H, thiazolyl-H), 7.67 (s, 1H, vinylic-H), 8.16 (br s, 1H, NH), and 11.66 (br s, 1H, NH); Anal.: Calcd. for $C_{23}H_{21}N_3O_4S_2$ (467): N, 8.99; S, 13.71; Found: N, 8.73; S, 13.69.

*5-[4′-(4″-Phenyl-(4‴-methyl)-thiazol-2″-yl-aminoethoxy)-3′,5′-dimethoxybenzylidenyl]-2,4-thiazolidinedione (**5f**).* IR (KBr, cm^{-1}): 3428 (2NH), 3122 (CH aromatic), 2975 and 2921 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1673 and 1592 (2CO stretching vibrations), 1305 (CN) and 1264 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 2.9 (s, 3H), 3.13 (t, 2H), 3.93 (s, 6H), 4.29 (t, 2H), 6.97–7.27 (m, 6H, Ar-H), 7.42 (s, 1H, thiazolyl-H), 7.93 (s, 1H, vinylic-H), 8.4 (br s, 1H, NH), and 11.65 (br s, 1H, NH); Anal.: Calcd. for $C_{24}H_{23}N_3O_5S_2$ (497): N, 8.45; S, 12.88; Found: N, 8.39; S, 12.83.

*5-[4′-(4″-Phenyl-(4‴-chloro)-thiazol-2″-yl-aminoethoxy)benzylidenyl]-2,4-thiazolidinedione (**5g**).* IR (KBr, cm^{-1}): 3429 (2NH), 3117 (CH aromatic), 2983 and 2932 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1667 and 1586 (2CO stretching vibrations), 1314 (CN), and 1249 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 3.01

(t, 2H), 4.31 (t, 2H), 7.12–7.38 (m, 8H, Ar-H), 7.59 (s, 1H, thiazolyl-H), 7.91 (s, 1H, vinylic-H), 8.37 (br s, 1H, NH), and 11.58 (br s, 1H, NH); Anal.: Calcd. for $C_{21}H_{16}ClN_3O_3S_2$ (457.5): N, 9.18; S, 13.99; Found: N, 9.06; S, 13.79.

*5-[4′-(4″-Phenyl-(4‴-chloro)-thiazol-2″-yl-aminoethoxy)-3′-methoxybenzylidenyl]-2,4-thiazolidinedione (***5h***).* IR (KBr, cm^{-1}): 3425 (2NH), 3117 (CH aromatic), 2974 and 2927 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1688 and 1590 (2CO stretching vibrations), 1303 (CN), and 1254 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 3.17 (t, 2H), 3.9 (s, 3H), 4.41 (t, 2H), 7.20–7.45 (m, 7H, Ar-H), 7.61 (s, 1H, thiazolyl-H), 7.94 (s, 1H, vinylic-H), 8.44 (br s, 1H, NH), and 11.67 (br s, 1H, NH); Anal.: Calcd. for $C_{22}H_{18}ClN_3O_4S_2$ (487.5): N, 8.62; S, 13.13; Found: N, 8.42; S, 13.01.

*5-[4′-(4″-Phenyl-(4‴-chloro)-thiazol-2″-yl-aminoethoxy)-3′,5′-dimethoxybenzylidenyl]-2,4-thiazolidinedione (***5i***).* IR (KBr, cm^{-1}): 3435 (2NH), 3124 (CH aromatic), 2972 and 2928 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1679 and 1586 (2CO stretching vibrations), 1311 (CN), and 1252 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 3.2 (t, 2H), 3.99 (s, 6H), 4.47 (t, 2H), 7.25–7.51 (m, 6H, Ar-H), 7.72 (s, 1H, thiazolyl-H), 7.91 (s, 1H, vinylic-H), 8.48 (br s, 1H, NH), and 11.71 (br s, 1H, NH); Anal.: Calcd. for $C_{23}H_{20}ClN_3O_5S_2$ (517.5): N, 8.12; S, 12.37; Found: N, 8.08; S, 12.39.

*Synthesis of 5-[4′-(2″/4″-Sulphonamido-4″-substituted phenyl aminoethoxy)-3′/5′-substituted benzylidenyl]-2,4-thiazolidinediones (***6a–f***): General Procedure*

A mixture of **2** (0.005 mol), 4-amino-substituted benzene sulphonamide (0.005 mol), powdered KOH (0.006 mol), and a catalytic amount of a PTC was dissolved in DMF (2 mL) and the reaction mixture was exposed to 450-W MW radiation for 4–5 min. It was then cooled and poured on to ice-cold water and the reaction mixture was then neutralized to pH 7. Thus, the crude product obtained was crystallized with aqueous DMF.

*5-[4′-(4″-Sulphonamidophenyl aminoethoxy)-benzylidenyl]-2,4-thiazolidinedione (***6a***).* IR (KBr, cm^{-1}): 3456 (2NH and NH_2), 3104 (CH aromatic), 2950 and 2929 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1676 and 1554 (2CO stretching vibrations), 1420 (CN stretching), 1306 and 1143 (SO_2 asymmetric and symmetric), and 1253 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 3.07 (t, 2H), 4.16 (t, 2H), 5.10 (br s, 1H, NH), 6.72–7.14 (m, 8H, Ar-H), 7.71 (s, 1H, vinylic-H), 10.12 (s, 2H, NH_2), and 11.20 (br s, 1H, NH); Anal.: Calcd. for $C_{18}H_{17}N_3O_5S_2$ (419): N, 10.03; S, 15.18; Found: N, 9.99; S, 15.17.

*5-[4′-(4″-Sulphonamidophenyl aminoethoxy)-3′-methoxybenzylidenyl]-2,4-thiazolidinedione (***6b***).* IR (KBr, cm^{-1}): 3461 (2NH and NH_2), 3111 (CH aromatic), 2957 and 2931 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1677 and 1551 (2CO stretching vibrations), 1421 (CN stretching), 1310 and 1140 (SO_2 asymmetric and symmetric), and 1258 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 3.12 (t, 2H), 3.82 (s, 3H), 4.22 (t, 2H), 5.23 (br s, 1H, NH), 6.8–7.34 (m, 7H, Ar-H), 7.83 (s, 1H, vinylic-H), 10.16 (s, 2H, NH_2), and 11.22 (br s, 1H, NH); Anal.: Calcd. for $C_{19}H_{19}N_3O_6S_2$ (449): N, 9.36; S, 14.26; Found: N, 9.31; S, 14.19.

*5-[4′-(4″-Sulphonamidophenyl aminoethoxy)-3′,5′-dimethoxybenzylidenyl]-2,4-thiazolidinedione (***6c***).* IR (KBr, cm^{-1}): 3466 (2NH and NH_2), 3120 (CH aromatic), 2959 and 2938 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1682 and 1556 (2CO stretching vibrations), 1425 (CN stretching), 1315 and 1147 (SO_2 asymmetric and symmetric), and 1260 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 3.21 (t, 2H), 3.91 (s, 6H), 4.35 (t, 2H), 5.36 (br s, 1H, NH), 6.95–7.48 (m, 6H, Ar-H), 7.87 (s, 1H, vinylic-H), 10.20 (s, 2H, NH_2), and 11.25 (br s, 1H, NH); Anal.: Calcd. for $C_{20}H_{21}N_3O_7S_2$ (479): N, 8.77; S, 13.37; Found: N, 8.72; S, 13.30.

*5-[4′-(2″-Sulphonamido-(4‴-methyl)-phenyl aminoethoxy)benzylidenyl]-2,4-thiazolidinedione (***6d***).* IR (KBr, cm^{-1}): 3472 (2NH and NH_2), 3125 (CH aromatic), 2968 and 2942 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1690 and 1564 (2CO stretching vibrations), 1431 (CN stretching), 1312 and 1154 (SO_2 asymmetric and symmetric), and 1259 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 2.91(s, 3H), 3.14 (t, 2H), 4.31 (t, 2H), 5.29 (br s, 1H, NH), 6.73–7.16 (m, 7H, Ar-H), 7.78 (s, 1H, vinylic-H), 10.18 (s, 2H, NH_2), and 11.23 (br s, 1H, NH); Anal.: Calcd. for $C_{19}H_{19}N_3O_5S_2$ (433): N, 9.70; S, 14.79; Found: N, 9.68; S, 14.75.

*5-[4′-(2″-Sulphonamido-(4‴-methyl)-phenyl aminoethoxy)-3′-methoxybenzylidenyl]-2,4-thiazolidinedione (***6e***).* IR (KBr, cm^{-1}): 3475 (2NH and NH_2), 3121 (CH aromatic), 2970 and 2947 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1686 and 1558 (2CO stretching vibrations), 1432 (CN stretching), 1320 and 1155 (SO_2

asymmetric and symmetric), and 1261 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 2.94 (s, 3H), 3.26 (t, 2H), 3.86 (s, 3H), 4.31 (t, 2H), 5.38 (br s, 1H, NH), 6.79–7.31 (m, 6H, Ar-H), 7.82 (s, 1H, vinylic-H), 10.14 (s, 2H, NH_2), and 11.25 (br s, 1H, NH); Anal.: Calcd. for $C_{20}H_{21}N_3O_6S_2$ (463): N, 9.08; S, 13.83; Found: N, 8.89; S, 13.78.

*5-[4′-(2″-Sulphonamido-(4‴-methyl)-phenyl aminoethoxy)-3′,5′-dimethoxybenzylidenyl]-2,4-thiazolidinedione (***6f***).* IR (KBr, cm^{-1}): 3477 (2NH and NH_2), 3128 (CH aromatic), 2973 and 2952 (CH aliphatic asymmetric and symmetric stretching vibrations, respectively), 1688 and 1572 (2CO stretching vibrations), 1441 (CN stretching), 1324 and 1161 (SO_2 asymmetric and symmetric), and 1273 (COC); ^{1}H NMR ($CDCl_3$ + DMSO-d_6, δ ppm): 2.95 (s, 3H), 3.46 (t, 2H), 3.93 (s, 6H), 4.42 (t, 2H), 5.42 (br s, 1H, NH), 6.96–7.43 (m, 5H, Ar-H), 7.88 (s, 1H, vinylic-H), 10.21 (s, 2H, NH_2), and 11.3 (br s, 1H, NH); Anal.: Calcd. for $C_{21}H_{23}N_3O_7S_2$ (493): N, 8.52; S, 12.99; Found: N, 8.47; S, 12.99.

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